Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII • EXAMINATION – SUMMER • 2014

Subject Code: 171003 **Date: 05-06-2014**

Subject Name: Digital Signal Processing

Time: 02.30 pm - 05.00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 (a) Answer the following **08**

(i) Check whether the following signal is periodic or not. If a signal is periodic, find its fundamental period.

$$X[n] = \cos^2\left(\frac{\pi}{8}\right)n$$

(ii) $X(n) = (-0.5)^n u(n)$. State whether it is energy or power signal. Justify

(iii) Define and explain the convolution and correlation.

(iv) Determine if the following system describe by,
$Y(t) = \text{Sin}[x(t+2)]$; is memory less, causal ,linear ,time invariant, stable.

(b) Answer the following **06**

(i) Compute the convolution $y(n) = x(n) * h(n)$, Where
$X(n) = \{1, 1, \underset{\uparrow}{0}, 1, 1\}$ and $h(n) = \{1, \underset{\uparrow}{-2}, -3, 4\}$

(ii) Determine if the systems described by following equations are causal or non causal and stable or not.

(1) $T[x(n)] = e^{x(n)}$

(2) $Y(n) = x(2n)$

(3) $Y(n) = x(n^2)$

Q.2 (a) State and prove the properties of Z- transform **07**

(i) Convolution of two sequence

(ii) Differentiation in Z domain

(b) Given the two sequence of the length 4 are: **07**
$X(n) = \{0, 1, 2, 3\}$ $h(n) = \{2, 1, 1, 2\}$
Find the circular convolution.

OR

(b) Using graphical method, obtain a 5- point circular convolution of two DT signals defined as, **07**

$X(n) = (1.5)^n, \quad 2 \geq n \geq 0$

$Y(n) = 2n-3, \quad 3 \geq n \geq 0$

Q.3 (a) Find Z transform and ROC of the following sequence. **07**

(i) $X_1(n) = [3[2^n] - 4[3^n]]\, u[n]$

(ii) $X_2(n) = [(0.5)^n \sin\frac{\pi n}{4}]\, u(n)$

(iii) $X_3(n) = n^2 - 2n + 3$ for $n \geq 0$

(b) State and prove the properties of DFT (I) Periodicity (II) Time shifting **07**

OR

Q.3 (a) Determine the response of the system, **07**

$Y(n) = \frac{5}{6}y(n-1) - \frac{1}{6}y(n-2) + x(n)$ to the input signals.

$X(n) = \delta(n) - \frac{1}{3}\delta(n-1)$

(b) State and prove the properties of DFT **07**
(I) Circular convolution (II) Multiplication of two sequences

Q.4 (a) The transfer function of discrete time causal system is given below **07**

$$H(z) = \frac{1-z^{-1}}{1-0.2z^{-1}+0.15z^{-2}}$$

Find the difference equation and draw cascade and parallel realization.

(b) Derive DIT FFT flow graph for N = 4 hence find DFT of **07**
x(n) = {1, 2, 3, 4}

OR

Q.4 (a) Consider discrete time linear causal system defined by difference equation. **07**

$$y(n) - \frac{3}{4}\, y(n-1) + \frac{1}{8}\, y(n-2) = x(n) + \frac{1}{3}\, X(n-1)$$

Obtain cascade realization of the same.

(b) Determine Inverse Z-transform of the following : **07**

$$X(z) = \frac{3z^{-3}}{\left(1-\frac{1}{4}z^{-1}\right)^2}\ ; \qquad x(n) \text{ left handed system.}$$

Q.5 (a) Compute the eight point DFT of a sequence **07**

$$X(n) = \left(\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, 0, 0, 0, 0\right)$$

Using decimation in time FFT algorithm.

(b) Write short note on multiplier-accumulator (MAC) hardware of DSP processor. **07**

OR

Q.5 (a) Determine the response [y(n)] of FIR filter. Input x(n) is (1,2,2,1) and h(n) is (1,2,3). Use DFT and IDFT formula. **07**

(b) Write short notes on: **07**

1. Harvard architecture of DSP processor.
2. Hanning Window and Kaiser Window Functions

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